

MICRO-G NEXT 2015 DESIGN CHALLENGES

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CHALLENGE: FLOAT SAMPLE GRABBER

NASA Mission Connection

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. One of the destinations of interest is an asteroid.

Asteroids are among the solar system's most primitive bodies and are interesting to scientists. A specific sample of interest are loosely adhered surface rocks called float samples. NASA needs a way to collect float samples without cross contamination between worksites.

Objective

Design and manufacture a sample collection and containment device which can mechanically obtain and secure a geology sample from loosely adhered surface rocks in microgravity.

Requirements

1. The device shall fit within a 8in x 8in x 18in volume
2. The device shall have a dry weigh less than 15 lbs
3. The device shall be compatible with a chlorine water environment
4. The device shall be capable of obtaining 3 samples
5. The device shall prevent cross contamination between sample sites
6. The device shall package the sample in order to prevent contamination during transportation
7. The device shall be capable of obtaining a sample between 1.5 and 0.25 inch diameter sphere
8. The device shall be capable of one-handed operation.
9. The device shall use only manual power
10. The device shall function after a 3 foot drop test onto concrete
11. The device shall have a tether attachment point

CHALLENGE: SURFACE SAMPLING DEVICE

NASA Mission Connection

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. One of the destinations of interest is an asteroid.

Asteroids are among the solar system's most primitive bodies and are interesting to scientists. A sample type of interest is a surface sample. A surface sample is the collection of the "top" layer of particulate resting on a larger body. Surface samples were successfully taken during the Apollo mission from behind rocks that shielded the surface dust from the landing plume of the LEM (Lunar Excursion Module)

Objective

Design and manufacture a surface sampling device to collect and protect a sample through transport back to Earth.

Requirements

1. The device shall fit within a 8in x 8in x 18in volume
2. The device shall have a dry weight of less than 10 lbs
3. The device shall be compatible with a chlorine water environment
4. The device shall maintain the orientation of the particles during sampling
5. The device shall maintain the orientation of the particles collected during transport back to earth
6. The device shall be capable of one-handed operation
7. The device shall use only manual power
8. The device shall be capable of collecting sample from dust size particles to 0.125 inch diameter spheres
9. The device shall have a tether attachment point
10. The device shall function after a 3 foot drop test onto concrete
11. The device shall be capable of obtaining at least two samples
12. The device shall prevent cross contamination between samples

CHALLENGE: CHARACTERISTIC ASTEROID SIMULANT FOR NASA MICROGRAVITY CHIP SAMPLE

NASA Mission Connection

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. One of the destinations of interest is an asteroid.

Asteroids are among the solar system's most primitive bodies and are interesting to scientists. One type of sample to be collected is a chip sample liberated from the parent body. NASA currently has a prototype of a microgravity chipping/containment system and needs a more representative way to test feasibility and operations in the Neutral Buoyancy Laboratory (NBL).

Developing a characteristic asteroid simulant to create a realistic chipping test is the purpose of this challenge.

Objective

Design, manufacture, and characterize key parameters of various simulated rocks to enable realistic chip sample evaluations in the Neutral Buoyancy Laboratory.

Requirements

1. The system shall be less than 40in x 40in x 12in
2. The system shall be compatible with a chlorine water environment
3. The system shall weigh less than 100 lbs (dry weight)
4. The system shall provide at least 4 targets of varying properties
5. The targets shall be easily replaceable once chipped
6. The targets shall have rough irregular surfaces and be either; concave, convex, or flat.
7. The individual target chipping forces shall be repeatable

CHALLENGE: CHARACTERISTIC ASTEROID SIMULANT FOR NASA MICROGRAVITY CORE DRILL

NASA Mission Connection

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. One of the destinations of interest is an asteroid.

Asteroids are among the solar system's most primitive bodies and are interesting to scientists. A specific type of sample of interest for collection is core sample. NASA currently has a first prototype of a microgravity core drill and needs a way to test drilling operations in the Neutral Buoyancy Laboratory (NBL).

Developing a characteristic asteroid simulant to create a realistic drilling test is the purpose of this challenge.

Objective

Design and manufacture a simulated rock to enable core drilling evaluations in the Neutral Buoyancy Laboratory.

Requirements

1. The system shall contain at least 2 targets
2. The target shall be at least 40in x 3in x 3in
3. The system is not required to enable an intact core to be taken
4. The system shall be compatible to work in a chlorine water environment
5. The target shall be embedded with neutrally buoyant rock simulators less than 1"x1"x1" that will be liberated during coring operations
6. The system shall have a dry weight less than 100 lbs

CHALLENGE: ROCK CHIP SAMPLING DEVICE FOR MICROGRAVITY BODIES

NASA Mission Connection

NASA is currently working on systems to take humans beyond Low Earth Orbit to explore the solar system. One of the destinations of interest is an asteroid.

Asteroids are among the solar system's most primitive bodies and are interesting to scientists. A specific sample of interest for collection is a 'chip' sample and is defined as a sample which is forcibly removed or broken off from a larger piece of the parent body.

Developing a functional prototype tool to break these samples from the asteroid safely while capturing and containing them for return to Earth is the purpose of this challenge.

Objective

Design and manufacture a method for an astronaut to break off and contain 'chip' style samples from an asteroid in microgravity.

Requirements

1. The system shall be capable of containing chips up to approx. 1"x1"x1"
2. The system shall be capable of creating chips less than approx. 1"x1"x1"
3. The system shall capture and retain at least one chip per sample site
4. The system shall provide for collection of samples from 3 separate sites without cross contamination between sites
5. The system shall provide for storage of samples independent of one another
6. The system shall prevent chipping debris from impacting the crew member
7. The system shall weigh less than 15 lbs, the lighter the better
8. Powered operations shall be driven manually, pneumatically, and/or hydraulically (with peanut oil)
9. The system shall be ambidextrous
10. The system shall work on rough surfaces that are either; concave, flat, or convex
11. The system shall be compatible with a chlorine water environment
12. The chipping task shall be capable of one-handed operation
13. The system shall function after a 3 foot drop test onto concrete
14. The system shall have a tether attachment point

Design Challenges contained in this document are intended for participants in Micro-g NEXt.